# Body Mass Index and Suicide Risks Among Patients in the U.S. Department of Veterans Affairs Health System

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# Suicide Among Veterans

- National concern and VHA priority

- VHA leads the nation in suicide prevention
  - Conducts ongoing assessments of rates, risks
  - Mandates suicide risk assessments
  - Operates innovative Veterans crisis hotline
  - Suicide Prevention Coordinators

# Suicide Mortality Among Individuals Receiving Treatment for Depression in the Veterans Affairs Health System: Associations with Patient and Treatment Setting Characteristics

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Suicide is a complex, multidetermined phenomenon.[1] There are individual-level biological and psychological contributors, in addition to social, environmental, and economic risk factors.[2–4] Rates of suicide also differ based on demographic and clinical characteristics. In the general population, the incidence of suicide is higher among older than among younger individuals[5] and among males than among females.[6] Whites are more likely to commit suicide than are African Americans, and older White men have the highest risk of suicide among all age and race groups.[6] Suicide rates vary with rates of gun ownership, poverty, employment status, geographical location, and levels of social support,[4,7,8] as well as other clinical and demographic characteristics. The US Surgeon General,[9] the Institute of Medicine,[4] and the Department of Veterans

*Objectives.* We sought to report clinical and demographic factors associated with suicide among depressed veterans in an attempt to determine what characteristics identified depressed veterans at high risk for suicide.

*Methods.* We used longitudinal, nationally representative data (1999–2004) to determine suicide rates among depressed veterans, estimating time until suicide using Cox proportional hazards regression models.

*Results.* Of 807 694 veterans meeting study criteria, 1683 (0.21%) committed suicide during follow-up. Increased suicide risks were observed among male, younger, and non-Hispanic White patients. Veterans without service-connected disabilities, with inpatient psychiatric hospitalizations in the year prior to their qualifying depression diagnosis, with comorbid substance use, and living in the southern or western United States were also at higher risk. Posttraumatic stress disorder (PTSD) with comorbid depression was associated with lower suicide rates, and younger depressed veterans with PTSD had a higher suicide rate than did older depressed veterans with PTSD.

*Conclusions.* Unlike the general population, older and younger veterans are more prone to suicide than are middle-aged veterans. Future research should examine the relationship between depression, PTSD, health service use, and suicide risks among veterans. (*Am J Public Health.* 2007;97:2193–2198. doi:10.2105/AJPH.2007.115477)

## Original Contribution

# Suicide Mortality Among Patients Receiving Care in the Veterans Health Administration Health System

John F. McCarthy, Marcia Valenstein, H. Myra Kim, Mark Ilgen, Kara Zivin, and Frederic C. Blow

Understanding and reducing mortality from suicide among veterans is a national priority, particularly for individuals receiving care from the US Veterans Health Administration (VHA). This report examines suicide rates among VHA patients and compares them with rates in the general population. Suicide mortality was assessed in fiscal year 2001 for patients alive at the start of that fiscal year and with VHA use in fiscal years 2000–2001 ($n = 4,692,034$). Deaths from suicide were identified by using National Death Index data. General population rates were identified by use of the Web-based Injury Statistics Query and Reporting System. VHA rates were 43.13/100,000 person-years for men and 10.41/100,000 person-years for women. For male patients, the age-adjusted standardized mortality ratio was 1.66; for females, it was 1.87. Male patients aged 30–79 years had increased risks relative to men in the general population; standardized mortality ratios ranged from 2.56 (ages 30–39 years) to 1.33 (ages 70–79 years). Female patients aged 40–59 years had greater risks than did women in the general population, with standardized mortality ratios of 2.15 (ages 40–49 years) and 2.36 (ages 50–59 years). Findings offer heretofore unavailable comparison points for health systems. Prior to the conflicts in Afghanistan and Iraq and before recent VHA initiatives, rates were higher among VHA patients than in the general population. Female patients had particularly high relative risks.

# Higher-risk periods for suicide among VA patients receiving depression treatment: Prioritizing suicide prevention efforts

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## Abstract

*Background:* Health systems with limited resources may have the greatest impact on suicide if their prevention efforts target the highest-risk treatment groups during the highest-risk periods. To date, few health systems have carefully segmented their depression treatment populations by level of risk and prioritized prevention efforts on this basis.

*Methods:* We conducted a retrospective cohort study of 887,859 VA patients receiving depression treatment between 4/1/1999 and 9/30/2004. We calculated suicide rates for five sequential 12-week periods following treatment events that health systems could readily identify: psychiatric hospitalizations, new antidepressant starts (>6 months without fills), "other" antidepressant starts, and dose changes. Using piecewise exponential models, we examined whether rates differed across time-periods. We also examined whether suicide rates differed by age-group in these periods.

*Results:* Over all time-periods, the suicide rate was 114/100,000 person-years (95% CI; 108, 120). In the first 12-week periods, suicide rates were: 568/100,000 p-y (95% CI; 493, 651) following psychiatric hospitalizations; 210/100,000 p-y (95% CI; 187, 236) following new antidepressant starts; 193/100,000 p-y (95% CI; 167, 222) following other starts; and 154/100,000 p-y (95% CI; 133, 177) following dose changes. Suicide rates remained above the base rate for 48 weeks following hospital discharge and 12 weeks following antidepressant events. Adults aged 61–80 years were at highest risk in the first 12-week periods.

*Conclusions:* To have the greatest impact on suicide, health systems should prioritize prevention efforts following psychiatric hospitalizations. If resources allow, closer monitoring may also be warranted in the first 12 weeks following antidepressant starts, across *all* age-groups.

# Understanding Suicide Risk Factors

- Suicide: Complex, multidetermined
  - Risk factors are variously understood and recognized

- Identification and analysis of risk factors
  - Enhance understanding of causes
  - Inform risk assessments
  - Guide suicide prevention initiatives

Veterans Health Administration
Employee Education System

# A Surprising Finding

# Suicide among male veterans: a prospective population-based study

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**Objectives:** To assess the risk of mortality from suicide among male veteran participants in a large population-based health survey.

**Design and setting:** A prospective follow-up study in the US. Data were obtained from the US National Health Interview Surveys 1986–94 and linked to the Multiple Cause of Death file (1986–97) through the National Death Index.

**Participants:** The sample comprised 320 890 men, aged $\geqslant 18$ years at baseline. The participants were followed up with respect to mortality for 12 years.

**Results:** Cox proportional hazards analysis showed that veterans who were white, those with $\geqslant 12$ years of education and those with activity limitations (after adjusting for medical and psychiatric morbidity) were at a greater risk for completing suicide. Veterans were twice as likely (adjusted hazard ratio 2.04, 95% CI 1.10 to 3.80) to die of suicide compared with non-veterans in the general population. The risk of death from "natural" causes (diseases) and the risk of death from "external" causes did not differ between the veterans and the non-veterans. Interestingly, male veterans who were overweight had a significantly lower risk of completing suicide than those who were of normal weight.

**Conclusions:** Veterans in the general US population, whether or not they are affiliated with the Department of Veterans Affairs (VA), are at an increased risk of suicide. With a projected rise in the incidence of functional impairment and psychiatric morbidity among veterans of the conflicts in Afghanistan and Iraq, clinical and community interventions that are directed towards patients in both VA and non-VA healthcare facilities are needed.

# Body Mass Index (BMI)

BMI = mass / (height*height)

|  | BMI | Prevalence, Veterans* |
|---|---|---|
| Underweight | <18.5 | 1.0% |
| Normal | 18.5-24.9 | 23.6% |
| Overweight | 25.0-29.9 | 42.6% |
| Obese | 30+ | 32.8% |

* Adjusting for age, sex, race/ethnicity; NHANES data, *Koepsel et al., 2011*

# Health Risks Vary by BMI

## Underweight

Increased mortality from non-cancer, non-cardiovascular disease

## Overweight and obesity status

Increased chronic illnesses

diabetes, gallbladder disease,
high blood pressure, osteoarthritis

Increased mortality

diabetes, CVD, cancer

Fewer excess non-cancer non-CVD deaths categorized as unintentional injuries, suicides or homicides

*(Flegal et al., 2007)*

# Obesity Associated with Depression

Depression is a well-recognized suicide risk factor
*(Ilgen et al., 2010)*

Obesity positively associated with depression
*(Simon et al., 2006)*

Meta-analysis finds positive association among women, yet not for men       *(de Wit et al., 2010)*

Veterans Health Administration
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# BMI and Suicide Attempts

Literature is limited and inconsistent.

*(Batty et al., 2010; Dong et al., 2006)*

BMI positively associated with suicidal ideation among women, negatively among men.

*(Carpenter et al., 2000)*

# BMI and Suicide:
# Consistent Inverse Association

Since 1966, large longitudinal studies find inverse association between BMI and suicide risk.

*Paffenbarger and Asnes,1966; Magnusson et al., 2005*
*Kaplan et al., 2007; Bjerkeset et al., 2008;*
*Mukamal et al., 2010; Jee et al., 2011;*
*Rebholz et al., 2011*

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*Rebholz et al., 2011*

A consistent pattern that goes "well beyond any possibility of chance alone."

*Mukamal and Miller (2010)*

# Seeking Explanations

Biological

Serotonin deficiency

Insulin resistance *(Golomb et al., 2002)*

However pattern persisted even when controlling for dietary omega-3 fatty acids *(Mukamal et al., 2007)*

Cholesterol

Yet cholesterol-lowering drugs have not increased suicide risks

# Seeking Explanations

Psychological and behavioral
    *Personality*
            Neuroticism *(Terracciano et al., 2009)*
                    *However, higher BMI associated with depression    (de Wit et al., 2010)*

# How may BMI act "downstream"?

Evaluation of associations between suicide risk factors and BMI.

    Greater "BMI may act 'downstream' of suicidal ideation or attempts in preventing suicide." (Mukamal & Miller, 2009)

Suicide mortality influenced by not only those factors influencing suicide attempts but also those affecting choice of method of attempt.

# Method of Suicide

Lethality of method influences outcome

Personal experiences, attributes and resources may affect choice of method

# Assessment in VHA

VHA largest integrated health system in US

Has an advanced electronic medical record system

Ongoing suicide assessments with NDI data

## Study Hypotheses:

H1: BMI inversely associated with suicide

H2: BMI inversely associated with lethality of method

Veterans Health Administration
Employee Education System

# Data Sources

VHA National Patient Care Database (NPCD)
Identify all VHA users with inpatient or outpatient encounters in FY01 or FY02 and alive at start of FY02

National Death Index
Gold standard for mortality assessment
Dates and causes of death
From death certificates, state vital statistics offices

VHA Corporate Data Warehouse
Height, weight

# Measures

Sex
Age( 18-29, 30-64, 65+)

Substance Use Disorder
Bipolar disorder
Major depression
Other depression
Other anxiety diagnoses
Post-traumatic stress disorder
Schizophrenia

Any MH treatment

COPD
Head Cancer
Hypertension
Diabetes
Autoimmune Disease
Dementia
Alcohol withdrawal delerium
Hemi/Paraplegia

Smoking
Eating Disorder

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# Measures

Suicide

    ICD-10 diagnoses:  X60-X84, and Y87.0

Causes of suicide death

    <u>higher lethality:</u>

        hanging, suffocation, or strangulation [X70];
        drowning [X71]; use of firearms [X72-X74];
        other causes [X75-X82, Y870]

    <u>lower lethality:</u>

        poisoning [X60-X69] and other methods[X83-X84]

BMI = 703 x (weight in pounds) / (height in inches$^2$)

| | |
|---|---|
| Underweight | <18.5 |
| Normal | 18.5-24.9 |
| Overweight | 25.0-29.9 |
| Obese | 30+ |

Excluded 1,020,530 with missing data

Study cohort:  4,005,640 patients

# Analyses

Descriptive statistics for cohort
    Overall and by BMI category and suicide status

Multivariable proportional hazards regression
    Covariates, including VHA regional network

    Covariance sandwich estimators to adjust for
        clustering of individuals within VA facilities

Risk time
    Begins

        first day of FY2002 for patients with use in FY2001
        day of first use in FY2002 for those without FY01 use
    Ends

        date of death or end of FY09, whichever first

| Characteristic | Total (N=4,005,640) | | Underweight (n=53,858; 1.4%) | | Normal (n=971,552; 24.3%) | | Overweight (n=1,625,348; 40.6%) | | Obese (n=1,354,882; 33.8%) | | Significance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | col % | N | col % | N | col % | N | col % | |
| Male | 3,793,122 | 94.70 | 49,651 | 92.19 | 907,652 | 93.42 | 1,559,221 | 95.93 | 1,276,598 | 94.22 | *** |
| Female | 212,518 | 5.30 | 4,207 | 7.81 | 63,900 | 6.58 | 66,127 | 4.07 | 78,284 | 5.78 | |
| Age, mean (SD) | 62.0 | 14.4 | 65.0 | 14.6 | 63.1 | 15.7 | 63.1 | 14.2 | 59.8 | 13.2 | *** |
| Age 18 to 29 | 85,847 | 2.10 | 1,095 | 2.03 | 30,496 | 3.14 | 31,923 | 1.96 | 22,333 | 1.65 | *** |
| Age 30 to 64 | 1,957,952 | 48.90 | 22,644 | 42.06 | 425,589 | 43.81 | 730,392 | 44.94 | 779,327 | 57.52 | *** |
| Age 65 plus | 1,961,841 | 49.00 | 30,119 | 55.91 | 515,467 | 53.06 | 863,033 | 53.10 | 553,222 | 40.83 | *** |
| Substance Use Disorder | 268,868 | 6.70 | 7,965 | 14.78 | 98,193 | 10.11 | 96,841 | 5.96 | 65,869 | 4.86 | *** |
| Bipolar disorder | 76,815 | 1.90 | 812 | 1.51 | 17,999 | 1.85 | 28,015 | 1.72 | 29,989 | 2.21 | *** |
| Major depression | 171,108 | 4.30 | 2,274 | 4.22 | 40,594 | 4.18 | 63,010 | 3.88 | 65,230 | 4.81 | *** |
| Other depression | 357,829 | 8.90 | 5,767 | 10.71 | 91,725 | 9.44 | 135,212 | 8.32 | 125,125 | 9.24 | *** |
| Other anxiety diagnoses | 202,914 | 5.10 | 3,195 | 5.93 | 53,698 | 5.53 | 79,709 | 4.90 | 66,312 | 4.89 | *** |
| Post-traumatic stress disorder | 207,536 | 5.20 | 2,100 | 3.90 | 44,506 | 4.58 | 78,756 | 4.85 | 82,174 | 6.07 | *** |
| Schizophrenia | 95,030 | 2.40 | 1,690 | 3.14 | 25,216 | 2.60 | 33,481 | 2.06 | 34,643 | 2.56 | *** |
| COPD | 567,822 | 14.18 | 19,732 | 36.63 | 167,188 | 17.21 | 199,186 | 12.25 | 181,716 | 13.41 | *** |
| Head Cancer | 21,825 | 0.54 | 1,675 | 3.11 | 8,934 | 0.92 | 7,129 | 0.44 | 4,087 | 0.30 | *** |
| Smoking | 476,361 | 11.89 | 12,380 | 22.99 | 150,720 | 15.51 | 177,234 | 10.90 | 136,027 | 10.04 | *** |
| Hypertension | 2,017,958 | 50.38 | 18,396 | 34.17 | 392,966 | 40.45 | 812,104 | 49.96 | 794,492 | 58.64 | *** |
| Diabetes | 842,972 | 21.06 | 4,606 | 8.56 | 121,755 | 12.53 | 307,496 | 18.92 | 409,115 | 30.20 | *** |
| Autoimmune Disease | 900,745 | 22.49 | 6,234 | 11.58 | 142,940 | 14.71 | 329,248 | 20.26 | 422,323 | 31.17 | *** |
| Dementia | 143,470 | 3.58 | 4,471 | 8.30 | 52,892 | 5.44 | 55,670 | 3.43 | 30,437 | 2.25 | *** |
| Alcohol withdrawal delerium | 22,812 | 0.57 | 1,116 | 2.07 | 10,351 | 1.07 | 7,552 | 0.46 | 3,793 | 0.28 | *** |
| Hemi/Paraplegia | 30,966 | 0.77 | 1,281 | 2.38 | 10,324 | 1.06 | 11,229 | 0.69 | 8,132 | 0.60 | *** |
| Eating Disorder | 1,413 | 0.04 | 100 | 0.19 | 437 | 0.04 | 268 | 0.02 | 608 | 0.04 | *** |
| Any MH treatment | 710,902 | 17.80 | 10,604 | 19.69 | 186,437 | 19.19 | 264,862 | 16.30 | 248,999 | 18.38 | *** |
| Died of any cause | 1,088790 | 27.2 | 33,571 | 62.3 | 348,848 | 35.9 | 410,781 | 25.3 | 295,590 | 21.8 | *** |
| Died of suicide | 10,169 | 0.30 | 170 | 0.30 | 3,146 | 0.30 | 4,117 | 0.30 | 2,736 | 0.20 | *** |

**Table 1. Patient Characteristics, by Body Mass Category**

# Patient Characteristics, Overall and by Suicide Status

| | Total (N=4,005,640) | | Suicide (n=10,169) | | Non-suicide (n=3,995,471) | | Significance |
|---|---|---|---|---|---|---|---|
| | N | % | N | col % | N | col % | |
| Underweight | 53,858 | 1.3 | 170 | 1.7 | 53,688 | 1.3 | *** |
| Normal | 971,552 | 24.3 | 3,146 | 30.9 | 968,406 | 24.2 | *** |
| Overweight | 1,625,348 | 40.6 | 4,117 | 40.5 | 1,621,231 | 40.6 | n.s. |
| Obese | 1,354,882 | 33.8 | 2,736 | 26.9 | 1,352,146 | 33.8 | *** |
| Male | 3,793,122 | 94.7 | 9,908 | 97.4 | 3,783,214 | 94.7 | *** |
| Female | 212,518 | 5.3 | 261 | 2.6 | 212,257 | 5.3 | *** |
| age 18 to 29 | 85,847 | 2.1 | 207 | 2 | 85,640 | 2.1 | n.s. |
| age 30 to 64 | 1,957,952 | 48.9 | 5,667 | 55.7 | 1,952,285 | 48.9 | *** |
| age 65 plus | 1,961,841 | 49 | 4,295 | 42.2 | 1,957,546 | 49 | *** |
| Substance use disorder | 268,868 | 6.7 | 1,554 | 15.3 | 267,314 | 6.7 | *** |
| Bipolar disorder | 76,815 | 1.9 | 675 | 6.6 | 76,140 | 1.9 | *** |
| Major depression | 171,108 | 4.3 | 1,093 | 10.7 | 170,015 | 4.3 | *** |
| Other depression | 357,829 | 8.9 | 1,689 | 16.6 | 356,140 | 8.9 | *** |
| Other anxiety | 202,914 | 5.1 | 1,058 | 10.4 | 201,856 | 5.1 | *** |
| Post-traumatic stress disorder | 207,536 | 5.2 | 891 | 8.8 | 206,645 | 5.2 | *** |
| Schizophrenia | 95,030 | 2.4 | 530 | 5.2 | 94,500 | 2.4 | *** |
| Any Mental Health treatment | 710,902 | 17.7 | 3,442 | 33.8 | 707,460 | 17.7 | *** |
| Eating Disorder | 1,413 | 0 | 6 | 0.1 | 1,407 | 0 | n.s. |
| COPD | 567,822 | 14.2 | 1,770 | 17.4 | 566,052 | 14.2 | *** |
| Head Cancer | 21,825 | 0.5 | 78 | 0.8 | 21,747 | 0.5 | *** |
| Smoking | 476,361 | 11.9 | 1,810 | 17.8 | 474,551 | 11.9 | *** |
| Hypertension | 2,017,958 | 50.4 | 4,548 | 44.7 | 2,013,410 | 50.4 | *** |
| Diabetes | 842,972 | 21 | 1,647 | 16.2 | 841,325 | 21.1 | *** |
| Autoimmune Disease** | 900,745 | 22.5 | 1,837 | 18.1 | 898,908 | 22.5 | *** |
| Dementia | 143,470 | 3.6 | 356 | 3.5 | 143,114 | 3.6 | n.s. |
| Alcohol withdrawal delerium | 22,812 | 0.6 | 190 | 1.9 | 22,622 | 0.6 | *** |
| Hemi/Paraplegia | 30,966 | 0.8 | 95 | 0.9 | 30,871 | 0.8 | * |

# Table 3.  Multivariable Proportional Hazards Regression Results

| | Hazard ratio | Lower bound 95%CI | Upper bound 95%CI | p-value |
|---|---|---|---|---|
| Underweight | **1.17** | **1.01** | **1.36** | **0.0418** |
| Normal | -- | -- | -- | -- |
| Overweight | **0.78** | **0.74** | **0.82** | **<.0001** |
| Obese | **0.63** | **0.60** | **0.66** | **<.0001** |
| Male | 2.74 | 2.40 | 3.12 | <.0001 |
| Female | -- | -- | -- | -- |
| age 18 to 29 | 0.80 | 0.69 | 0.92 | 0.002 |
| age 30 to 64 | 0.85 | 0.80 | 0.90 | <.0001 |
| age 65 plus | -- | -- | -- | -- |
| Any SUD | 1.34 | 1.24 | 1.45 | <.0001 |
| Bipolar | 1.98 | 1.81 | 2.16 | <.0001 |
| Major depression | 1.89 | 1.75 | 2.05 | <.0001 |
| Other depression | 1.68 | 1.57 | 1.81 | <.0001 |
| Other anxiety | 1.34 | 1.24 | 1.44 | <.0001 |
| PTSD | 0.89 | 0.82 | 0.97 | 0.01 |
| Schizophrenia | 1.30 | 1.18 | 1.44 | <.0001 |
| Any MH treatment | 1.33 | 1.24 | 1.43 | <.0001 |
| Eating Disorder | 1.07 | 0.53 | 2.18 | 0.8493 |
| Chronic Obstr. Pul. Dis. | 1.28 | 1.22 | 1.35 | <.0001 |
| Head Cancer | 1.69 | 1.35 | 2.11 | <.0001 |
| Smoking | 1.15 | 1.09 | 1.21 | <.0001 |
| Hypertension | 0.88 | 0.84 | 0.91 | <.0001 |
| Diabetes | 0.77 | 0.66 | 0.89 | 0.0006 |
| Autoimmune Disease** | 1.15 | 1.00 | 1.34 | 0.0569 |
| Dementia | 0.91 | 0.80 | 1.03 | 0.1418 |
| Alcohol withdrawal delirium | 1.33 | 1.12 | 1.59 | 0.0015 |
| Hemi/Paraplegia | 1.19 | 0.97 | 1.46 | 0.0934 |

# Table 4: Method of Suicide by BMI category, Among Suicide Decedents

| | | | | BMI Category | | | | | | | | Signif. |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | | | Underweight | | Normal | | Overweight | | Obese | | |
| | | N | col % | N | col % | N | col % | N | col % | N | col % | |
| **Total** | | 10,169 | 100 | 170 | 100 | 3,146 | 100 | 4,117 | 100 | 2,736 | 100 | |
| | | | | | | | | | | | | *** |
| | Firearms | 6,972 | 68.6 | 131 | **77.1** | 2,104 | **66.9** | 2,875 | **69.8** | 1,862 | **68.1** | |
| | Poisoning | 1,474 | 14.5 | 16 | **9.4** | 442 | **14.0** | 556 | **13.5** | 460 | **16.8** | |
| | Suffocation | 1,076 | 10.6 | 12 | **7.1** | 385 | **12.2** | 434 | **10.5** | 245 | **9.0** | |
| | Other | 647 | 6.4 | 11 | **6.5** | 215 | **6.8** | 252 | **6.1** | 169 | **6.2** | |
| **Male** | Firearms | 6,890 | 69.5 | 130 | **79.3** | 2,071 | **67.8** | 2,852 | **70.6** | 1,837 | **69.3** | *** |
| | Poisoning | 1,349 | 13.6 | 12 | **7.3** | 404 | **13.2** | 515 | **12.8** | 418 | **15.8** | |
| | Suffocation | 1,050 | 10.6 | 11 | **6.7** | 373 | **12.2** | 428 | **10.6** | 238 | **9.0** | |
| | Other | 619 | 6.2 | 11 | **6.7** | 206 | **6.7** | 244 | **6.0** | 158 | **6.0** | |
| **Age 30-64** | Firearms | 3,312 | 58.4 | 54 | **62.1** | 968 | **55.9** | 1,284 | **59.5** | 1,006 | **59.5** | *** |
| | Poisoning | 1,176 | 20.8 | 15 | **17.2** | 347 | **20.0** | 418 | **19.4** | 396 | **23.4** | |
| | Suffocation | 749 | 13.2 | 10 | **11.5** | 272 | **15.7** | 289 | **13.4** | 178 | **10.5** | |
| | Other | 430 | 7.6 | 8 | **9.2** | 144 | **8.3** | 166 | **7.7** | 112 | **6.6** | |

# Table 5: Violent vs. Non-Violent Suicide, by BMI Category, among Suicide Decedents

| | | All | | Underweight | | Normal | | Overweight | | Obese | | Signif. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | N | col % | N | col % | N | col % | N | col % | N | col % | |
| **Total** | | 10,169 | 100 | 170 | 100 | 3,146 | 100 | 4,117 | 100 | 2,736 | 100 | *** |
| | High lethality | 8,622 | 84.8 | 152 | **89.4** | 2,679 | **85.2** | 3,534 | **85.8** | 2,257 | **82.5** | |
| | Low lethality | 1,547 | 15.2 | 18 | **10.6** | 467 | **14.8** | 583 | **14.2** | 479 | **17.5** | |
| | Total | 10,169 | 100.0 | 170 | 100.0 | 3,146 | 100.0 | 4,117 | 100.0 | 2,736 | 100.0 | |
| | | | | | | | | | | | | *** |
| **Male** | High lethality | 8,488 | 85.7 | 150 | **91.5** | 2,626 | **86.0** | 3,498 | **86.6** | 2,214 | **83.5** | |
| | Low lethality | 1,420 | 14.3 | 14 | **8.5** | 428 | **14.0** | 541 | **13.4** | 437 | **16.5** | |
| | Subtotal | 9908 | 100.0 | 164 | 100.0 | 3054 | 100.0 | 4039 | 100.0 | 2651 | 100.0 | |
| | | | | | | | | | | | | |
| **By Age** | | | | | | | | | | | | n.s. |
| **Age 18-29** | High lethality | 169 | 81.6 | 3 | 100.0 | 67 | 84.8 | 67 | 78.8 | 32 | 80.0 | |
| | Low lethality | 38 | 18.4 | 0 | 0.0 | 12 | 15.2 | 18 | 21.2 | 8 | 20.0 | |
| | Subtotal | 207 | 100.0 | 3 | 100.0 | 79 | 100.0 | 85 | 100.0 | 40 | 100.0 | |
| | | | | | | | | | | | | * |
| **Age 30-64** | High lethality | 4,441 | 78.4 | 70 | **80.5** | 1,367 | **79.0** | 1,724 | **79.9** | 1,280 | **75.7** | |
| | Low lethality | 1,226 | 21.6 | 17 | **19.5** | 364 | **21.0** | 433 | **20.1** | 412 | **24.3** | |
| | Subtotal | 5667 | 100.0 | 87 | 100.0 | 1731 | 100.0 | 2157 | 100.0 | 1692 | 100.0 | |
| | | | | | | | | | | | | n.s. |
| **Age 65and over** | High lethality | 4,012 | 93.4 | 79 | 98.8 | 1,245 | 93.2 | 1,743 | 93.0 | 945 | 94.1 | |
| | Low lethality | 283 | 6.6 | 1 | 1.3 | 91 | 6.8 | 132 | 7.0 | 59 | 5.9 | |
| | Subtotal | 4295 | 100.0 | 80 | 100.0 | 1336 | 100.0 | 1875 | 100.0 | 1004 | 100.0 | |

BMI Category

# Discussion

We began with Kaplan's "surprising" finding among Veterans…

The literature suggests increased psychiatric risk factors with greater BMI. (Simon et al., 2006; de Wit, 2010)

Yet an inverse association has been consistently observed.

Quest for analysis of factors "downstream" of ideation…

What underlies the BMI-associated differences in means?

It doesn't seem to be limited differential access to lethal mean. Overweight and obese individuals more likely to have a loaded firearm at home.

*(Mukamal & Miller, 2009)*

Further work is needed to understand those factors that underlie individuals' choices of suicide method.

Although interventions affecting access to lethal means are regarded as successful, it remains important to understand factors that may influence suicide behavior despite access barriers.

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# Study Limitations

20% of VHA patient population was excluded due to missing anthropometric data.

       Patients who were excluded from the study were less likely to be male, older, or to have had diagnosed psychiatric conditions.

Although adjusted for VHA regional network, analyses did not include rural/urban status (McCarthy et al., 2012), to avoid further missing data.

       Sensitivity analyses with rural/urban status were consistent with study findings.

Height and weight data in the Corporate Data Warehouse may be affected by measurement error

       -- accuracy of equipment

       -- whether patients are measured with shoes on

       -- whether providers sometimes rely on self-reports

       -- potentially differentially missing/inaccurate for certain patient subpopulations (wheelchair bound patients, obese patients, amputees)

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# Conclusions

Among VHA patients, BMI inversely associated with suicide risks, despite adjustment for patient and clinical factors.

Finds confirm and advance the evidence base.

Major contribution:  Method of suicide varies by BMI category
        Greater use of highly lethal methods among those
        with lower body mass index scores.

The observed differential in lethality of method of suicide may partly explain the inverse association.

Future study should seek focus on those factors that affect choice of suicide method.

# Contact information

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